A

BOTANICAL NOTE-BOOK

FOR THE USE OF STUDENTS

OF

PRACTICAL BOTANY.

BY

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PREFACE.

The BOTANICAL NOTE-BOOK has been prepared with the view of furnishing students of botany with a practical exercise book.

The glossary of botanical terms does not take the place of a text book, and should not be used for memorizing definitions and descriptions. It has been inserted for reference only, and is intended to provide in convenient form the information that is constantly required in pursuing a regular course in plant analysis.

The use of the blank schedules will secure the systematic study of the plants examined. The floral schedule is the same as that used at the Departmental examinations. The others also are simple and complete. In filling up the blanks only what is really observed should be recorded. The drawing in outline of the parts of the plants examined cannot be too highly recommended. It is a means of expression especially valuable in botanical descriptions. When several plants of the same order have been examined, their descriptions should be compared, and the leading characters of the order observed and recorded in the proper place in the form.

The exercises under "Laboratory Work" will be found useful. While they afford pleasing variety in the study, they will lead the student to discover for himself important facts, and will train him in the habits of patient enquiry and careful observation, and inference so necessary in every department of scientific study.

COLLEGIATE INSTITUTE,
OWEN SOUND, 15th August, 1887.

THE PRINCIPAL

BOTANICAL TERMS

USED IN THE DESCRIPTION OF PLANTS,

ANALYTICALLY ARRANGED AND EXPLAINED.

ROOT.

The Descending Axis of the Plant.

KIND.

PRIMARY.—Those which grow from the lower extremity of the radicle. See Parts of Seed, page 19.

SECONDARY OR ADVENTITIOUS.—Those which grow from other parts of the stem than the radicle.

SHAPE.

TAP.—A distinct central axis, emitting small rootlets.

(a) *Conical*, broadest at the top and tapering to the lower end (Fig. 1). Ex., Carrot.

(b) *Fusiform*, broadest at the middle and tapering to both ends (Fig. 2). Ex., Radish.

(c) *Napiform*, Turnip-shaped (Fig. 3).

FIBROUS.—Root-fibers springing in a cluster from the radicle (Fig. 4).

(a) Roots with small fibres.

(b) *Fascicled*, clustered, thickened and fleshy (Fig. 5). Ex., Peony.

(c) *Moniliform*, necklace-shaped; cylindrical and contracted at intervals (Fig. 6).

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

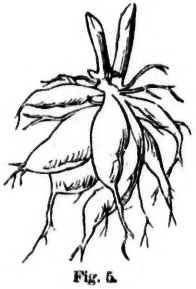


Fig. 5.

Fig. 6.

SITUATION.

TERRESTRIAL.—Growing underground.

ÆRIAL.—Growing from points of the stem above ground. Ex., Indian Corn.

AQUATIC.—Growing solely in the water. Ex., Lemna.

DURATION.

ANNUAL.—Those of plants which last but one year or season.

BIENNIAL.—Those of plants which last two years or seasons.

PERENNIAL.—Those of plants which last from year to year.

STEM.

The Ascending Axis of the Plant.

PARTS.

NODES.—Points from which leaves arise (Fig. 7).

INTERNODES.—Portions of the stem between the nodes (Fig. 7).

AXILS.—The angles on the upper side between the leaves and the stem (Fig. 7.)

CLASS.

EXOGENOUS.—Character of plants with exogenous stems.

(a) They have net-veined leaves (Fig. 8 B).

(b) The parts of the flowers are in fours or fives, very rarely in three or in sixes (Fig. 8 E.)

(c) They are outside growers, the wood forming in rings (Fig. 8 A).

(d) They are dicolytedonous (Fig. 8 C.) See Cellular Structure of Exogens, page 22.

(e) They have a true bark (Fig. 8 A d.)

ENDOGENOUS.—Character of plants with endogenous stems.

(a) They have, with few exceptions, straight-veined leaves Fig. 9 B.)

(b) The parts of the flower are in threes or in sixes, never in fives (Fig. 9 E.)

(c) They are inside growers, the wood being interspersed in separate bundles throughout the stem (Fig. 9 A.)

(d) They are monocotyledonous (Fig. 9 C). See Cellular Structure of Endogens, page 23.

(e) They have no true bark.

ACROGENOUS.—Character of plants with acrogenous stems.

(a) The leaves are fork-veined.

(b) They are flowerless.

(c) They are summit growers, the stem being formed by the union of the bases of fronds.

(d) They are acotyledonous.

KIND.

ÆRIAL.—Stems above ground.

(a) *Caulis*, stem of ordinary herbaceous plants.

(b) *Truncus*, stem of trees.

(c) *Caudex*, stem of palms.

(d) *Culm*, stem of grasses.

(e) *Stipe*, the leaf-stalk of ferns.

SUBTERRANEAN.

(a) *Rhizoma*, or *Rootstock*, a horizontally elongated, more or less subterranean stem, sending out roots from its lower side and leaf-buds from its upper (Fig. 10). Ex., Calamus, Solomon's Seal.

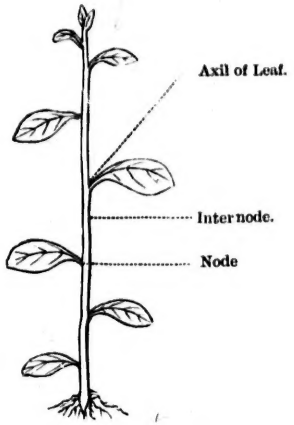


Fig. 7.

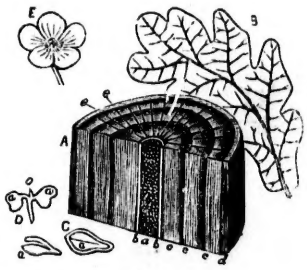


Fig. 8.

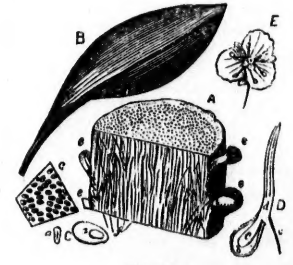


Fig. 9.


Fig. 10.

(b) *Tuber*, a short and thickened subterranean stem or branch provided with buds (*eyes*) (Fig. 11). Ex., White Potato.

(c) *Bulb*, a modified, usually underground bud or undeveloped stem with imbricated fleshy leaves or scales (Fig. 12). Ex., Onion, Hyacinth.

(d) *Corm*, a solid bulb (Fig. 13). Ex., Indian Turnip, Crocus.

Fig. 11.

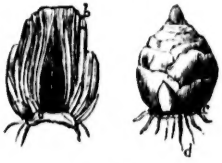


Fig. 12.

ACAULESCENT.—Stems so short as to be almost indistinguishable.

CONSISTENCE.

LIGNEOUS.—Woody in texture.

HERBACEOUS.—Not woody; of a soft texture like an herb.

FRUTICOSE.—Semi-ligneous, shrubby.

Fig. 13.

SHAPE.

The shape is described by some appropriate adjective, such as *rounded, half-rounded, triangular, square, fluted, furrowed*, etc.

SURFACE.

See Leaf.

DIRECTION.

ERECT.—Standing upright (Fig. 7).

DROOPING.—Bending over (Fig. 14).

CREEPING.—Lying along the ground and rooting (Fig. 22). Ex., Strawberry.

TRAILING.—Lying loosely along the ground (Fig. 15).

ASCENDING.—Standing obliquely (Fig. 16).

CLIMBING.—Clinging by tendrils to objects about them (Fig. 17). Ex., Grape-vine

TWINING.—Ascending spirally around a support. (Fig. 18). Ex., Hop.

DIFFUSE.—Spreading loosely. Ex., Red Currant.

Fig. 14.

Fig. 15.

Fig. 16.

JUICE.

Described by some appropriate adjective, such as *watery, milky, acid, acrid*, etc.

BUDS.

Undeveloped stems or branches, each of which is composed of a solid conical base supporting a number of rudimentary leaves (*leaf-buds*), or flowers (*flower-buds*). In the leaf-bud the conical base represents the future stem with its internodes yet undeveloped, and the rudimentary leaves are all either the future leaves (*naked buds*), or some of the outer ones are modified, forming protective scales, which fall off when the bud is expanded (*scaly buds*) (Fig. 19).

Fig. 17.

Fig. 18.

Fig. 19.

TERMINAL.—When found on the extremity of the principal axis (Fig. 20, a).

AXILLARY.—When found in the axils of leaves (Fig. 20, b).

Accessory, when two or more are found in the axil of a leaf (Fig. 21).

ADVENTITIOUS.—When found without order on stems, roots, or leaves.

Fig. 20.

Fig. 21.

BRANCHES.

ARRANGEMENTS.—See Leaf.

MODIFICATIONS.

(a) *Stolon*, a branch that bends downward to the earth and takes root (Fig. 22.) Ex., Currant.

(b) *Sucker*, a subterranean branch, which after running horizontally, rises out of the ground and forms an erect stem (Fig. 22). Ex., Rose.

(c) *Runner*, a slender prostrate branch, rooting at the ends or at the joints (Fig. 22). Ex., Strawberry.

(d) *Offset*, a short, prostrate rooting branch, with a tuft of leaves at the end (Fig. 23). Ex., Houseleek.

(e) *Tendril*, a thread-like, prolonged branch, leafless and coiling spirally. Ex., Grape-vine. Sometimes a slender prolongation of the midrib of a leaf. Ex., Pea.

(f) *Spine*, an indurated, sharp pointed, abnormally developed branch. Ex., Hawthorn.

Runner. Sucker. Stolon.

Fig. 22.

LEAF.

PARTS.

LAMINA OR BLADE.—The broad, expanded portion (Fig. 24. a)

PETIOLE.—The leaf-stalk (Fig. 24 b.).

SHEATH.—A leaf-stalk which surrounds the stem (Fig. 25).

Petiolate, furnished with a petiole (Fig. 24).

Sessile, without a petiole (Fig. 16).

Sheathed, when the leaf-stalk surrounds the stem (Fig. 25).

STIPULES.—Two leaf-like appendages sometimes found at the base of the petiole (Fig. 24 c. c.).

Stipulate, furnished with stipules.

Exstipulate, without stipules (Fig. 16).

LIGULE.—The scale-like stipule which grows at the point of union of the blade and sheath in the leaves of grasses (Fig. 25).

Fig. 23.

SITUATION.

RADICAL.—Those which appear to spring from the root.

CAULINE.—Those which spring from the stem or its branches.

Fig. 24.

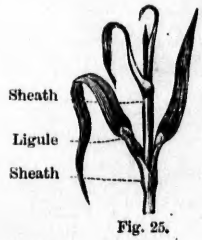


Fig. 25.

ARRANGEMENT.

ALTERNATE.—When only one leaf arises from each node (Fig. 7).

OPPOSITE.—When two leaves, one on each side of the stem, arise from each node (Fig. 16).

WHORLED.—When there are several leaves in a circle at each node (Fig. 26).

KIND.

SIMPLE.—A leaf in which the blade consists of a single piece (Fig. 24).

COMPOUND.—A leaf in which the blade consists of separate pieces, called *leaflets*.

(a) *Pinnate*, one in which the leaflets are arranged on each side of a midrib (Fig. 27).

Odd pinnate, where there is a leaflet at the end (Fig. 27) *Abruptly pinnate*, when there is not.

Twice-pinnate, when the primary division are themselves pinnate (Fig. 28).

Thrice-pinnate, when the secondary division are themselves pinnate.

Interruptedly-pinnate, when large and small leaflets alternate with each other (Fig. 29).

(b) *Palmate*, one in which several leaflets spring from the end of a common petiole (Fig. 30).

In describing a compound leaf the number of leaflets present should be indicated by some appropriate term, such as *tri-foliate*, *five-foliate*, *seven-foliate*, etc.

VENATION.

NET-VEINED.—When the veins branch and form a net-work.

(a) *Pinnate*, when there is one central rib (*the midrib*) and lateral branches (Fig 31).

(b) *Palmate*, when there are several ribs of about the same size, radiating from end of the petiole (Fig. 53).

STRAIGHT-VEINED.—When the veins run nearly parallel from the base to the apex, or from the midrib to the edge (Figs. 32 and 33).

OUTLINE.

BROADEST NEAR THE MIDDLE.

(a) *Acicular*, when very slender, stiff and pointed like a needle (Fig. 34). Ex., Pine.

(b) *Linear*, when at least four times as long as broad, and of nearly the same width from the base to near the apex (Fig. 35). Ex., Grasses.

(c) *Oblong*, when three or four times as long as broad, and with ends equally rounded off (Fig. 36). Ex., Milkweed.

(d) *Oval*, when two or three times as long as broad and with ends equally rounded off (Fig. 37). Ex., Apple.

(e) *Orbicular*, when nearly circular (Fig. 38). Ex., Round-leaved Mallow.


Fig. 26.


Fig. 27.


Fig. 28.


Fig. 29.


Fig. 30.


Fig. 31.


Fig. 32.


Fig. 33.


Fig. 34.


35


Fig. 36.


Fig. 37.


Fig. 38.

BROADEST NEAR THE BASE.

(a) *Subulate*, when awl-shaped (Fig. 39). Ex., Pipewort, Juniper.

(b) *Lanceolate*, when three or four times as long as broad, and narrowed to a point both at the base and apex (Fig. 40). Ex., Willow.

(b) *Ovate*, when like a vertical section of a hen's egg (Fig. 41). Ex., Beech.

(d) *Deltoid*, when about as broad as long, and narrowed to a point at the apex (Fig. 42). Ex., White Birch.

BROADEST NEAR THE APEX.

(a) *Oblanceolate*, when the reverse of lanceolate, that is lanceolate with the narrower end down (Fig. 43).

(b) *Spatulate*, when rounded above, and long and narrow below, like a spatula (Fig. 44). Ex., Ox-eye Daisy.

(c) *Obovate*, when the reverse of ovate, that is ovate with the narrower end down (Fig. 45).

(d) *Cuneate* or wedge shape, when broad above and tapering by straight lines to a point (Fig. 46). Ex., Horse-chestnut.


Fig. 39.


Fig. 40.


Fig. 41.


Fig. 42.


Fig. 43.


Fig. 44.

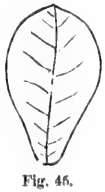


Fig. 45.


Fig. 46.


Fig. 47.

MARGIN.

ENTIRE.—When the margin is not indented in any way. (Fig. 47).

SERRATE.—When it has sharp teeth pointing in the direction of the apex (Fig. 48).

Doubly Serrate, when the edges of the large teeth are themselves finely serrate.

DENTATE.—When it has sharp teeth pointing outwards. (Fig. 49.)

CRENATE.—When it has rounded teeth. (Fig. 50).

REPAND.—When it is wavy (Fig. 51).

LOBED.—When divided into lobes or divisions by incisions (*Sinuses*) (Fig. 52).

Pinnately Lobed, lobed and pinnately veined.

Pinnatifid, when the incisions are deep and the leaf pinnately veined.

Bipinnatifid, pinnately veined and with the lobes themselves lobed.

Palmately Lobed, lobed and palmately veined.

Palmatifid, when the incisions are deep and the leaf palmately veined (Fig. 53).

Pedate, palmately veined and with the lateral lobes themselves lobed (Fig. 54).

Lyrate, when the terminal lobe is the largest and the others decrease in size towards the base (Fig. 55).


Fig. 48.


Fig. 49.


Fig. 50.


Fig. 51.


Fig. 52.


Fig. 53.


Fig. 54.


Fig. 55.

Laciniate, irregularly cut into narrow segments (Fig. 56). Ex., Bladderwort.

Runcinate, when the lobes point towards the base. (Fig. 57). Ex., Dandelion.

Multifid, when divided into fine segments. Ex., Dicentra.

In the description of a lobed leaf the following points should be noted :

(a) The number of lobes.

(b) Whether the leaf is palmately or pinnately veined.

(c) The shape of the lobes.

(d) Whether the terminal or basal lobes are the same size as the others.

(e) The depth and shape of the incisions.

Fig. 56.

Fig. 57.

58. 59. 60. 61. 62.

63. 64. 65. 66.

APEX.

ACUMINATE.—When the end is prolonged into a narrow, tapering point (Fig. 58).

ACUTE.—When the end is an acute angle (Fig. 59).

OBTUSE.—When the end is blunt or rounded Fig. 60).

TRUNCATE.—When the end appears to be cut off nearly square (Fig. 61).

RETUSE.—When the summit is rounded and slightly indented (Fig. 62).

EMARGINATE.—When notched at the summit (Fig. 63).

OBCORDATE.—When inversely heart-shaped (Fig. 64).

CUSPIDATE.—When tipped with a sharp rigid point (Fig. 65).

MUCRONATE.—When abruptly tipped with a small, short point (Fig. 66).

Fig. 67.

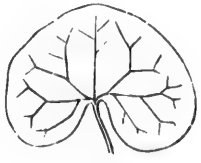


Fig. 68.

BASE.

CORDATE, or *heart-shaped*.—When rounded and turned in where the petiole is attached (Fig. 67).

RENIFORM.—When broadly cordate (Fig. 68).

AURICULAR.—When there is a pair of small blunt projections at the base (Fig. 69). Ex., Magnolia.

HASTATE.—When there are spreading lobes at the base (Fig. 70).

SAGITTATE.—When there are sharp lobes pointing downwards (Fig. 71). Ex., Sagittaria.

OBLIQUE.—When one side of the base is longer and lower than the other (Fig. 72). Ex., Begonia, Elm.

TAPERING.—When the blade tapers off at the base (Fig. 43).

CLASPING.—When the base folds around the stem (Fig. 73).

PERFOLIATE.—When two lobes at the base are prolonged beyond the stem and unite, the stem appearing to pass through the leaf (Fig. 74). Ex., Bellwort.

CONNATE.—When the bases of two leaves grow together around the stem (Fig. 75). Ex., Honeysuckle.

Fig. 69.

Fig. 70.

Fig. 71.

Fig. 72.

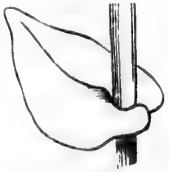


Fig. 73.

Fig. 74.

Fig. 75.

DECURRENT.—When the lower part of the midrib grows to the stem (Fig. 76). Ex., Thistle.

PELTATE.—When the petiole is attached to any part of the under surface instead of to the edge (Fig. 77). Ex., Watershield.

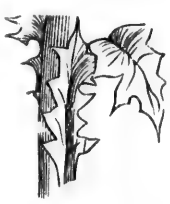


Fig. 76.

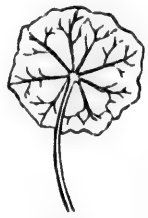


Fig. 77.

SURFACE.

GLABROUS.—Smooth, without hairs.

HAIRY.—When covered or partially covered with hairs.

(a) *Pubescent*, having dense, short and soft hairs.
(b) *Villous*, having dense long and weak hairs.
(c) *Sericeous*, having silky hairs.
(d) *Lanuginous*, when woolly or downy.
(e) *Tomentose*, covered with hairs; matted like felt.
(f) *Pilose*, having few short and soft hairs.
(g) *Hirsute*, having few long hairs.
(h) *Hispid*, having few long and stiff hairs.
(i) *Ciliate*, having hairs on the margin only.

GLAUCOUS.—When covered with a whitish bloom which rubs off.

DURATION.

FUGACIOUS.—When falling early in the season.

DECIDUOUS.—When falling at the end of the season.

PERSISTENT.—When remaining through the winter.

Fig. 78.

INFLORESCENCE.

The Arrangement of the Flowers on the Stem or on its Branches.

PARTS OF AN INFLOERSCENCE OR FLOWER-CLUSTER.

FLOWER.

PEDUNCLE.—The stem of a solitary flower or flower-cluster (Fig. 78).

PEDICEL.—The stem of each flower in a cluster (Fig. 78).

SCAPE.—A leafless peduncle proceeding from the base of the stem or apparently from the root (Fig. 79).

BRACTS.—The small leaves of a flower-cluster.

INVOLUCRE.—A whorl of bracts (Fig. 78).

KIND.

INDETERMINATE OR INDEFINITE.—When each flower of the cluster springs from an axillary bud. See page 4.

(a) *Solitary*, when but one flower springs from the axil of a bract.

(b) *Clustered*, when a group of flowers springs from the axil of a bract.

Raceme, A cluster in which the flowers are borne on pedicels of about equal length along a single axis (Fig. 80). Ex., Currant, Lily of the Valley.

Fig. 79.

Fig. 80.

Panicle, a compound raceme (Fig. 81). Ex., Oats.

Thyrse, a compact panicle (Fig. 82). Ex., Lilac.

Umbel, a cluster in which the flowers reach about the same level, their pedicels starting from the same point (Fig. 83). Ex., Milkweed.

Compound Umbel, when the peduncle branches into a number of secondary umbels (Fig. 84). Ex., Parsnip.

Corymb, a cluster in which the flowers reach about the same level, their pedicels starting from different points on a central axis (Fig. 85). Ex., Hawthorn.

Spike, a cluster in which the flowers are sessile, on a more or less lengthened axis (Fig. 86). Ex., Mullein.

Head, a round or roundish cluster of flowers which are sessile on a very short axis or receptacle (Fig. 87). Ex., Clover.

Spadix, a fleshy spike or head with small and often imperfect flowers, generally covered by a large bract called a *spathe* (Fig. 88) Ex., Indian Turnip.

Catkin or *Ament*, a slender, pendant spike, with scaly bracts (Fig. 89). Ex., Willow.

Fig. 81.

Fig. 82.

Fig. 83.

Fig. 84

Fig. 85.

Fig. 86.

Fig. 87.

88.

Fig. 89.

Fig. 90.

Fig. 91.

DETERMINATE OR DEFINITE. — When the flowers spring from terminal buds. See page 4.

(a) *Solitary*, when but one flower springs from the end of a stem or branch (Fig. 79).

(b) *Clustered*, when a group of flowers springs from the end of a stem or branch.

Cyme, a flat-topped or convex flower-cluster, the central blossom of which opens first (Fig. 90). Ex., Elder.

Fascicle, a close cyme (Fig. 91). Ex., Sweet William.

Glomerule, a dense head-like cyme. Ex., Mint.

FLOWER.

PARTS.

RECEPTACLE.—The end of the flower-stalk which bears the floral organs (Fig. 92).

FLORAL ENVELOPES.

(a) *Calyx*, the outer or protective whorl of flower-leaves, usually green (Fig. 92).

(b) *Corolla*, the second or attractive whorl of flower-leaves usually white or delicately colored, rarely green (Fig. 92).

(c) *Perianth*, a term applied to both floral envelopes when they are so nearly alike that one cannot be distinguished from the other (Fig. 92).

ESSENTIAL ORGANS.

(a) *Stamens*, the third whorl consisting usually of slender, thread-like organs (Fig. 92).

(b) *Pistil*, the central organ of the flower (Fig. 92).

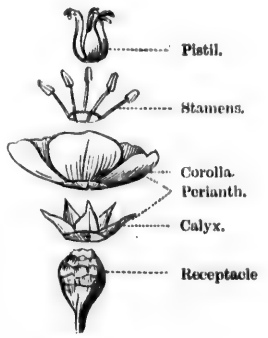


Fig. 92.

PERFECTNESS.

PERFECT.—When provided with both stamens and pistil (Fig. 93).

IMPERFECT.—When not provided with both stamens and pistil.

(a) *Staminate*, when provided with stamens, and without a pistil (Fig. 94).

(b) *Pistillate*, when provided with a pistil, and without stamens (Fig. 95).

(c) *Neutral*, having neither stamens nor pistil (Fig. 96).

(d) *Monœcious*, having stamens and pistils in separate flowers on the same plant. Ex., Cucumber.

(e) *Diœcious*, having stamens and pistils in separate flowers on different plants. Ex., Willow.

POLYGAMOUS.—When provided with both perfect and imperfect flowers on the same or on different plants. Ex., Maple.


Fig. 93.


Fig. 94.


Fig. 95.

COMPLETENESS.

COMPLETE.—When provided with the four kinds of floral organs (Fig. 99).

INCOMPLETE.—When not so provided.

(a) *Apetalous*, when the corolla is wanting (Fig. 97).

(b) *Achlamydeous*, when both calyx and corolla are wanting (Fig. 93).


Fig. 96.


Fig. 97.

REGULARITY.

REGULAR.—When all the parts of each set of organs are alike in size and shape.

IRREGULAR.—When all the parts of each set of organs are not alike in size and shape.

SYMMETRY.

SYMMETRICAL.—When the parts of each set of organs are of the same number or multiples of the same number.

UNSYMMETRICAL.—When the parts of each set of organs are not of the same number or multiples of the same number.

CALYX.

PARTS.

SEPALS.—The leaves of the calyx (Fig. 92).

TUBE.—The united portion of a gamosepalous calyx (Fig. 103).

THROAT.—The entrance to the tube of a gamosepalous calyx (Fig. 103).

LOBES or TEETH.—The divided parts of a gamosepalous calyx (Fig. 103).

PAPPUS.—The scales, teeth, bristles, or hairs forming the calyx border in plants of the Compositæ (Fig. 98).


Fig. 98.

Fig. 95.

COHESION.

POLYSEPALOUS.—When the sepals are not in any way united (Fig. 99).

GAMOSEPALOUS.—When the sepals are more or less grown together by their edges (Fig. 106).

Fig. 99.

ADHESION.

INFERIOR.—When the calyx is free from the ovary (Fig. 99).

SUPERIOR.—When the calyx is adherent to the ovary (Fig. 100).

FORM.

See Corolla.

ÆSTIVATION.

See Corolla.

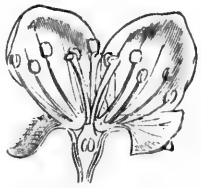


Fig. 100.

DURATION.

PERSISTENT.—When the calyx remains after the corolla has fallen away. Ex., Mallow.

CADUCOUS.—When the calyx disappears at the opening of the flower. Ex., Bloodroot.

DECIDUOUS.—When the calyx falls away at the same time as the corolla.

FORM OF SEPALS.

Described by the same terms as are used in the description of leaves.

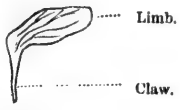


Fig. 101.

FUNCTION.

To protect the *Essential Organs* of the flower.

COROLLA.

PARTS.

PETALS.—The leaves of the corolla (Fig. 92).

Lamina, or limb, the expanded portion of the petal (Fig. 101).

Claw, the narrow or stalk-like base of some petals (Fig. 101).

Spur, the tubular prolongation of certain petals (Fig. 102).

Corona, an appendage at the top of the claw of some petals (Fig. 117). Ex., Silene.

Fig. 102.

TUBE.—The united portion of a gamopetalous corolla (Fig. 103).

THROAT.—The entrance to the tube of a gamopetalous corolla (Fig. 103).

LOBES.—The divided parts of a gamopetalous corolla (Fig. 103).

Fig. 103.

COHESION.

POLYPETALOUS.—When the petals are not in any way united (Fig. 99).

GAMOPETALOUS.—When the petals are more or less grown together by their edges (Fig. 104).

ADHESION.

HYPOGYNOUS.—When inserted under the pistil (Fig. 99).

PERIGYNOUS.—When inserted on the calyx (Fig. 100).

EPIGYNOUS.—When inserted on the ovary (Fig. 106).

SHAPE.

1. Of Gamopetalous Corollas:

REGULAR.—When the sepals are of the same shape and size.

(a) *Tubular*, when the whole or greater part of it is in the form of a tube or cylinder (Fig. 105). Ex., Honeysuckle.

(b) *Campanulate*, when bell-shaped (Fig. 106). Ex., Harebell.

(c) *Rotate*, when the petals or lobes are spread out horizontally (Fig. 107). Ex., Potato.

(d) *Urceolate*, or urn-shaped, when the tube is swollen or nearly globular, contracted at the top, and slightly expanded again in a narrow rim (Fig. 108). Ex., Whortleberry.

(e) *Salver-shaped*, when the lower part is cylindrical and the upper part expanded horizontally (Fig. 109). Ex., Phlox.

(f) *Funnel-shaped*, when the tube is cylindrical at the base and enlarged at the top into a bell-shaped limb (Fig. 110). Ex., Morning Glory.

IRREGULAR.—When the petals or lobes are not of the same shape or size.

(a) *Labiate*, when in a four or five lobed corolla, the two or three upper lobes stand apart, like an upper lip, from the lower ones or under lip (Fig. 111). Ex., Catnip.

Personate, when two-lipped, and the throat of tube closed (Fig. 112). Ex., Snap-dragon.

Ringent, when the two lips are widely separated (Fig. 113). Ex., Toadflax.

(b) *Ligulate*, when strap-shaped (Fig. 114). Ex., Dandelion.

2. Of Polypetalous Corollas:

REGULAR.

Rosaceous, when the petals are without claws (Fig. 99).

Lilaceous, when the petals have gradually spreading claws (Fig. 115).

Cruciferous, when there are four clawed petals arranged in the form of a cross (Fig. 116). Ex., Mustard.

Caryophyllaceous, when there are long claws enclosed in a tube (Fig. 117). Ex., Pink.

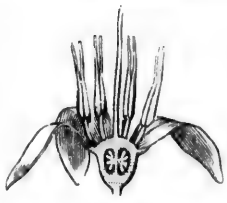


Fig. 104.


Fig. 105.


Fig. 106.


Fig. 107.


Fig. 108.


Fig. 109.


Fig. 110.


Fig. 111.


Fig. 112.


Fig. 113.


Fig. 114.


Fig. 115.


Fig. 116.


Fig. 117.

IRREGULAR.

Papilionaceous, consisting of five petals; one, the *vexillum* or standard, usually the largest, superior; two, the *alæ* or wings, lateral; two, the *carina* or keel, inferior, often more or less united and usually inclosing the stamens and pistil (Fig. 118). Ex., Pea.

Fig. 118.


Fig. 119

SHAPE OF PETALS.

Described by the leaf-terms. See Leaf.

ÆSTIVATION, *or arrangement of floral organs in the bud.*

IMBRICATE.—When the margins of contiguous pieces overlap one another (Fig. 119).


Fig. 120.

VALVATE.—When they merely touch one another by their edges (Fig. 120).

Induplicate.—When, valvate, with their margins turned inwards (Fig. 121).


Fig. 121.

Reduplicate.—When valvate, with their margins turned outwards (Fig. 122).


Fig. 122.

CONVOLUTE.—When each petal overlaps an adjoining one on one side, and is overlapped by the other adjoining one on the other side (Fig. 123).


Fig. 123.

PLICATE.—The folding of a gamopetalous corolla (Fig. 124).

Supervolute.—When folded and the plaits turned obliquely in the same direction (Fig. 125).


Fig. 124.


Fig. 125.

FUNCTION.

To protect the *Essential Organs* and to attract insects.

STAMENS.

PARTS.

FILAMENT.—The stem-like part of the stamens (Fig. 126).

ANTHER.—The enlarged part at the upper end of the filament. It generally consists of two oblong cells (Fig 126).

POLLEN.—The fertilizing dust or powder contained in the anther (Fig. 126).

CONNECTIVE.—The rib between the cells of the anther (Fig. 126).

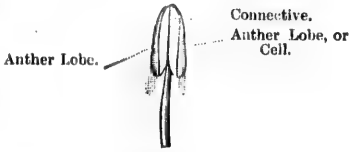


Fig. 126.

The parts of the stamen are really modified parts of a leaf, the filament being a petiole, and the anther cells being formed from the lamina as shown in Fig. 127.


Fig. 127.

COHESION.

MONANDROUS, DIANDROUS, etc., according to their number, when the stamens are entirely distinct from one another.

INDEFINITE.—When the stamens are distinct and more than twenty.

SYNGENESIOUS.—When the anthers are united in a circle while the filaments are separate (Fig. 114). Ex., Dandeloin.

MONADELPHOUS.—When the filaments are united to form a tube while the anthers are distinct (Fig. 128). Ex., Mallow.

DIADELPHOUS.—When united by their filaments into two groups (Fig. 129). Ex., Pea.

TRIADELPHOUS.—When united by their filaments into three groups. Ex., Hypericum.

POLYADELPHOUS.—When united by their filaments into more than three groups.

Fig. 128.

Fig. 129.

Fig. 130.

ADHESION.

HYPOGYNOUS.—When inserted on the receptacle (Fig. 99).

PERIGYNOUS.—When inserted on the calyx (Fig. 100.)

EPIGYNOUS.—When inserted on the ovary (Fig. 104).

EPIPETALOUS.—When inserted on the corolla (Fig. 130).

GYNANDROUS.—When inserted on the style (Fig. 131).

Fig. 131.

Fig. 132.

Fig. 133.

LENGTH.

SESILE.—When the filament is wanting (Fig. 130).

EXSERTED.—When the stamens project beyond the corolla (Fig. 104).

INCLUDED.—When they do not project beyond the corolla (Fig. 99).

DIDYNAMOUS.—Four in number, two long and two short (Fig. 132).

TETRADYNAMOUS.—Six in number, four long and two short (Fig. 133). Ex., Plants of the Cruciferæ.

ATTACHMENT OF FILAMENT AND ANTHER.

INNATE.—When the extremity of the filament is attached to the base of the connective (Fig. 134).

ADNATE.—When the connective is attached by its whole length to the filament (Fig. 135).

VERSATILE.—When the extremity of the filament is attached to the connective near the middle of its back (Fig. 136).

Fig. 134.

Fig. 135.

Fig. 136.

Fig. 137.

FACING.

INTROSE.—When the face is turned to the centre of the flower (Fig. 137).

EXTROSE.—When the face is turned outwards (Fig. 138).

Fig. 138.

Fig. 139.

140.

DEHISCENCE OF THE ANTHER.

LONGITUDINAL or VERTICAL.—When the anther opens by a slit along its length (Fig. 139).

TRANSVERSE.—When opening cross-wise (Fig. 140).

POROUS.—When opening by terminal pores (Fig. 141).

VALVULAR.—When a portion of the anther is lifted up to emit the pollen (Fig. 142).

Fig. 141.

Fig. 142.

FORM OF FILAMENT.

FILIFORM.—When thread-like (Fig. 99).

SUBULATE.—When tapering like an awl (Fig. 143).

CAPILLARY.—When hair-like and not strong enough to stand vertically.

DILATED.—When flattened out.

PETALOID.—When resembling a petal in form (Fig. 144).

BIDENTATE.—When toothed at the summit or at the base (Fig. 145).

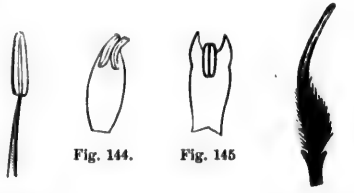


Fig. 143. Fig. 144. Fig. 145 Fig. 146.

FUNCTION.

To produce the pollen, which fertilizes the ovules.

PISTIL.

PARTS.

CARPEL.—A simple pistil, or one of the elements of a compound or multiple one.

OVARY.—The enlarged part of the pistil, containing the ovules (Fig. 146).

Cell, one of the divisions or cavities of the ovary (Fig. 147, 148, 149).

Dissepiments, the separating walls or partitions (Fig. 149).

Ovules, the unfertilized seeds (Figs. 147, 148, 149).

Primine, the outer coat of an ovule (Fig. 150).

Secundine, the inner coat of an ovule (Fig. 150).

Micropyle, the opening in the coats of an ovule (Fig 150).

Nucleus, the part in which the embryo is formed. (Fig. 150).

Chalaza, the place where the coats and the nucleus join (Fig. 150).

Hilum, the point of attachment to the ovule (Fig. 150).

Rhaphe, the connection between the hilum and the chalaza (Fig. 150).

Placenta, the line or projection to which the ovules are attached (Figs. 147, 148, 149).

Ventral Suture, the inner edge of a simple carpel, formed by the union of the margins of a leaf (Fig. 151).

Dorsal Suture, the outer edge of a simple carpel, corresponding to the midrib of a leaf (Fig. 151).

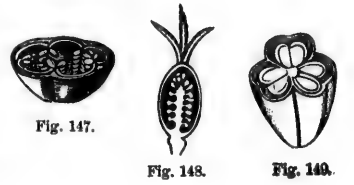


Fig. 147. Fig. 148. Fig. 149.

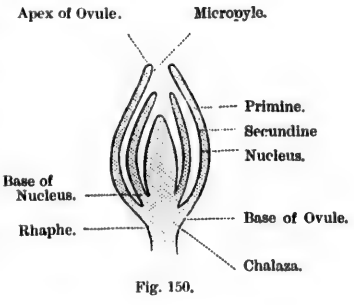


Fig. 150.

STYLE.—The stem-like part of the pistil above the ovary (Fig. 146).

STIGMA.—The rough top of the style, which receives the pollen (Fig. 146).

Each carpel of the pistil is really a modified leaf, the edges of which coming in contact, grow together. The tapering apex of the leaf, rolled together and prolonged, forms the style, while the stigma is formed from the upper edges of the leaf turned outwards (Fig. 151).

Fig. 151.

KIND.

SIMPLE.—One which consists of a single carpel (Fig. 151).

COMPOUND.—One which consists of several united carpels (Fig. 152).

MULTIPLE.—One which consists of several distinct carpels (Fig. 153).

Fig. 152.

Fig. 153.

COHESION.

APOCARPOUS.—When the carpels are distinct (Fig. 153).

SYNCARPOUS.—When the carpels are united (Fig. 152.

ADHESION.

INFERIOR.—When the calyx adheres to the ovary (Fig. 100).

SUPERIOR.—When the calyx is free from the ovary (Fig. 99).

PLACENTATION.

PARIETAL.—When the ovary has but one cell, and the ovules are borne on its walls (Fig. 147).

FREE CENTRAL.—When the ovary has but one cell, and the ovules are attached to a central column (Fig. 148).

CENTRAL OR AXILE.—When the pistil is syncarpous and the ovules are attached to a central column (Fig. 149).

FORM OF STYLE.

Described by the same terms as the form of the filament.

KIND OF OVULES.

ORTHOTROPOUS.—Those in which the base of the nucleus and the base of the ovule are in the same position, while the micropyle is at the apex (Fig. 154). Ex., Buckwheat.

Fig. 154.

CAMPYLOTROPOUS.—Those in which the micropyle or apex is bent over close to the base (Fig. 155). Ex., Bean.

ANATROPOUS.—Those which are turned so as to bring the micropyle to the hilum (Fig. 155 A). Ex., Magnolia.

AMPHITROPOUS.—Those which are half inverted, and have a short rhaphe.

FERTILIZATION OF THE OVULE.

When the pollen grain comes in contact with the moist stigma, it swells. the outer coat breaks, and a tubular prolongation of the inner coat, carrying within it the liquid contents of the grain, penetrates the stigma, grows down through the style, enters the cavity of the ovary, passes through the micropyle of an ovule, and reaches the embyro-sac, formed in the nucleus. The tubes then become empty, and in a short time the embryo appears in the embrvo-sac. The ovule may then be regarded as a seed.

Fig. 155.

KIND OF STIGMA.

SESSILE.—When attached to the ovary, the style being absent.

BIFID.—When two-cleft.

TRIFID.—When three-cleft.

LOBED.—When rounded.

Fig. 155 A.

GLOBOSE.—When globular.

FEATHERED.—When like a feather.

LINEAR.—When thread-like.

FUNCTION.

To produce the ovules, which, when fertilized by the pollen, become the seed from which new plants are produced.

Fig. 156.


Fig. 157.

FRUIT.

The Matured Pistil with Whatever Adheres to It.

PARTS.

SEED.—The part which contains the embryo (Fig. 180).

PERICARP.—The covering of the seeds, formed of the ovary and whatever adheres to it.

Epicarp, the outer layer (Fig. 156, Ep.).

Mesocarp, the middle layer (Fig. 156, Mes.).

Endocarp, the inner layer (Fig. 156, En.).

KIND.

SIMPLE.—Those formed by the ripening of a single pistil.

(a) *Fleshy*, those which are indehiscent and have two or more seeds embedded in a pulpy mass.

Berry, an indehiscent fruit, having the seeds embedded in a soft, juicy pulp, surrounded by a membranous rind (Fig. 157). Ex., Currant, Grape, Gooseberry, Cranberry, Tomato.

Hesperidium, an indehiscent fruit, having the seeds embedded in a soft, juicy pulp, surrounded by a leathery rind (Fig, 158). Ex., Orange, Lemon.

Pepo, an indehiscent fruit, having the seeds embedded in a pulpy mass, surrounded by a hard rind (Fig. 159). Ex., Melon, Squash, Cucumber, Pumpkin.

Pome, an indehiscent fruit, having the seeds in cells, surrounded by a succulent enlargement of the calyx Fig. 160). Ex., Apple, Pear, Quince, Hawthorn.


Fig. 158.


Fig 159.

(b) *Drupe* or *Stone Fruit*, an indehiscent, one-celled, one or two seeded fruit, having the endocarp (the *putamen*) hard or strony, and the mesocarp (the *sarcocarp*) fleshy (Fig. 156). Fx., Plum, Peach, Cherry.


Fig. 160.


Fig. 161.

(c) *Indehiscent Dry Fruits:*

Achene, an indehiscent, dry, hard, one-seeded fruit, having a separable pericarp (Fig. 161). Ex., Buttercup.

Utricle, an achene with a thin, loose, bladdery pericarp (Fig. 162). Ex., Goosefoot, Amaranth.

Caryopsis or *Grain*, an indehiscent, dry, hard, one-seeded fruit, having the pericarp adherent to the seed (Fig. 163). Ex., Wheat, Barley, Oats, Indian Corn.

Nut, an indehiscent, dry, hard, one-seeded fruit, produced from a syncarpous pistil. It is often surrounded by an involucre called a *cupule* (Fig. 164). Ex., Oak, Beech, Chestnut.


Fig. 162.


Fig. 163.


Fig. 164.

Samara or *Key*, a nut or achene with a winged apex or margin (Fig. 165). Ex., Birch, Elm, Ash.

(d) *Dehiscent Dry Fruits:*

Follicle, a pod formed of a simple pistil, and dehiscent by the ventral suture (Fig. 166). Ex., Marsh-Marigold, Milkweed.

Legume, a pod formed of a simple pistil, with dorsal and ventral sutures and dehiscent by both (Fig. 167). Ex., Pea, Bean.

Loment, a legume divided transversely into two or more one-seeded joints (Fig. 168). Ex., Desmodium.

Capsule, the pod of a compound pistil (Fig. 169). Ex., Mallow, St. John's Wort.

Silique, a long, slender capsule, two-valved with a membranous partition, from which the valves separate in dehiscence (Fig. 170). Ex., Plants of the Cruciferæ.

Silicle, a short, broad silique (Fig. 171). Ex., Shepherd's Purse.

Pyxis, a pod which dehisces by the falling off of the upper part as a lid (Fig. 172). Ex., Plantain, Pimpernel.

AGGREGATE.—Those formed by the aggregation of several carpels belonging to the same flower into a mass on the receptacle.

Etærio, an aggregation of drupes (Fig. 173). Ex., Raspberry, Blackberry.

ACCESSORY.—Those of which the fleshy portion belongs, not to the pistil, but to some other part separate from it (Fig. 174). Ex., Strawberry, which consists of an enlarged receptacle, bearing numerous achenes; Rose-hip, which consists of a calyx-tube lined with a hollow receptacle bearing bony achenes.

MULTIPLE.—Those formed by the aggregation of several separate flowers into one mass.

Sorosis, a fleshy multiple fruit (Fig. 175). Ex., Pine Apple, Mulberry.

Syconus, a multiple fruit which results from the union of several flowers in a fleshy, hollow receptacle. Ex., Fig.

Strobile or *Cone*, a scaly multiple fruit (Fig. 176). Ex., Pine, Hop.

Galbulus, a cone, the scales of which are fleshy and firmly coherent. Ex., Juniper Berry.

DEHISCENCE.

SEPTICIDAL.—Opening through the partitions *(dissepiments)* (Fig. 177).

LOCULICIDAL.—Opening at the dorsal suture (Fig. 178).

SEPTIFRAGAL.—Opening by the falling away of valves from the partitions (Fig. 179).

CIRCUMSCISSILE.—Opening by a circular horizontal line, cutting off as a lid the upper part of a pod (Fig. 172).


Fig. 165.


Fig. 166.


Fig. 167.


Fig. 168.


Fig. 169.


Fig. 179.


Fig. 171.


Fig. 172.


Fig. 173.


Fig. 174.


Fig. 175.


Fig. 176.


Fig. 177.


Fig. 178.


Fig. 179.

SEED.

The Matured Ovule

PARTS.

NUCLEUS.—Containing :

(a) ***Embryo,*** the undeveloped plantlet (Fig. 180, e)

Radicle, the stem-part of the embryo (Fig. 181, R).

Cotyledons, the first leaves of the embryo (Fig. 181, C).

Plumule, the bud or growing point of the embryo above the cotyledons (Fig. 181, P).

(b) ***Albumen,*** the food stored on the outside of the embryo for the plantlet's first growth (Fig. 180, d).

INTEGUMENTS OR COATS.

(a) ***Testa,*** the outer coat (Fig. 180, b).

(b) ***Tegmen,*** the inner coat (Fig. 180, c).

(c) ***Funiculus,*** the stalk by which the seed is attached to the placenta.

(d) ***Hilum,*** the scar on the testa where it separates from the seed-stalk (Fig. 180, a).

(e) ***Aril,*** covering on the outside of the integuments of certain seeds (Fig. 182). Ex., White Water Lily, May Apple.

(f) ***Coma,*** a tuft of hairs on certain seeds (Fig. 183). Ex., Milkweed.

Fig. 180.

Fig. 181.


Fig. 182.


Fig. 183.

KIND.

See KIND OF OVULES under Pistil.

NUMBER OF COTYLEDONS.

MONOCOTYLEDONOUS.—Having one cotyledon.

DICOTYLEDONOUS.—Having two cotyledons.

POLYCOTYLEDONOUS.—Having more than two cotyledons.

ACOTYLEDONOUS.—Without cotyledons.

TEXTURE OF ALBUMEN.

Described by an appropriate adjective, such as, ***farinaceous*** or ***mealy, oily, mucilaginous*** or ***mucilage-like, ruminated*** or ***wrinkled.***

POSITION OF EMBRYO.

ECCENTRIC.—When the embryo is on one side of the albumen (Fig. 163).

PERIPHERIC.—When the embryo surrounds the albumen (Fig. 184).

ACCUMBENT.—When the radicle is bent and lies along the edge of the cotyledons (Fig. 185).

INCUMBENT.—When the radicle rests against the back of one of the cotyledons (Fig. 186).

Conduplicate, when the cotyledons are incumbent and so folded as to embrace the radicle.


Fig. 184.


Fig. 185.


Fig. 186.

DIRECTION OF EMBRYO.

ASCENDING.—When the radicle points to the apex of the fruit.

DESCENDING.—When it points to its base.

CENTRIPETAL.—When the radicle is turned towards the axis of the fruit.

CENTRIFUGAL.—When turned towards the sides.

VAGUE.—When it bears no definite or uniform relation to the pericarp.

STRUCTURAL ELEMENTS.

THE CELL.

The elementary structure which is the foundation of all vegetable tissue (Fig. 187).

PARTS OF CELL.

CELL-WALL.—The outer membrane, composed of *cellulose*, a compound of carbon, hydrogen, and oxygen (Fig. 187, a).

PRIMORDIAL UTRICLE.—A delicate mucilaginous film, lining the cell-wall.

NUCLEUS.—A soft solid or gelatinous body, occupying a portion of the cavity of the cell (Fig. 187, c).

PROTOPLASM.—A mucilaginous, semi-fluid substance, composed of carbon, hydrogen, oxygen, and nitrogen. It is the essential part of the cell, which may at first be a mere mass of it without walls. The nucleus is merely a differentiated portion of it, and all the other parts of the cell are formed from it. In the living cell there is a constant circulation kept up in the protoplasm, termed *cycl sis*. In Fig. 187, b, the protoplasm is shown contracted by alcohol.

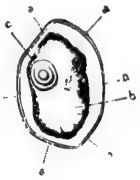


Fig. 187.

CELL-SAP.—A watery fluid, containing various dissolved salts, sugar, starch, chlorophyll, &c. See Contents of Cells.

CONTENTS OF CELLS.

The principal substances found in the cells are :

CHLOROPHYLL.—The green colouring matter of plants, found floating in the fluid of cells in the form of minute granules. It occurs principally in the cells of leaves and green stems. Light is necessary to its development, hence plants lose their green colour when kept in the dark. Its chief function is to decompose the carbon dioxide taken in by the stomata of the leaves. (See Assimilation, below). The variety in the tints of leaves in autumn is due to the different stages of oxygenation of the chlorophyll.

CHROMULE.—The colouring matter of plants other than green.

STARCH ($C_6H_{10}O_5$) occurs in the seeds, as in those of wheat and other cereal grains, and also in leguminous plants; in roots and in tubers, as in the potato; in the stem and pith of plants, as in the sago; in some barks, as in that of cinnamon; and in pulpy fruits, such as the apple.

SUGAR occurs in the sap of most plants. There are two varieties of it: cane-sugar ($C_{12}H_{22}O_{11}$) produced from sugar-cane, sugar-maple, beet, etc.; and grape-sugar ($C_6H_{12}O_6$), found in grapes, gooseberries, currants, peaches, etc.

GUM or MUCILAGE is found in vegetable tissues. It exists largely in vegetable juices, and exudes from the bark of many trees.

FIXED OILS occur in the seeds, fruits and other parts of plants.

VOLATILE OILS, RESINS and CAOUTCHOUC are usually the product of special secreting cells, and are often stored in intercellular spaces or reservoirs.

CRYSTALS OF LIME SALTS occur in the cavities of cells and also in the cell-walls of plants. They are mostly composed of calcium oxalate.

Raphides, the needle-shaped crystals found in monocotyledonous plants.

VEGETABLE ACIDS, either free or united with bases, occur in many plants. The principal are: *Malic*, found in apples, cherries, rhubarb, etc.; *Tartaric*, found in grapes, etc.; *Citric*, found in limes, lemons, etc.; *Tanic*, found in the bark and the leaves of oaks, elms, etc.; *Oxalic*, usually in combination with lime.

Fig. 188.

189.

TISSUE.

The fabric formed by the multiplication of the cells.

CELLULAR TISSUE.—Tissue formed of walled cells, more or less spherical in form. It is the first tissue formed, and the other varieties of tissue are but modifications of it, due principally to change in the shape of the cells, and to thickening and hardening of the cell-walls. The soft parts of plants consist of it (Fig. 188).

Parenchyma, a general name given to ordinary membranous cellular tissue.

WOODY TISSUE.—Tissue formed of elongated cells with thickened walls, usually tapering at the ends and overlapping one another. It is tenacious and elastic. The principal part of the wood, of the inner bark, and of the petioles and ribs of leaves is composed of it (Fig. 191).

Prosenchyma, a general name for tissue formed of elongated cells.

Fig. 190.

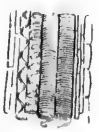


Fig. 191.

VASCULAR TISSUE OR VESSELS.—Tissue consisting of vessels or ducts formed from vertical rows of cells which have had their transverse partition walls obliterated. The walls of these ducts are dotted (Fig. 190), or marked with spiral or other markings (Fig. 191). This tissue is found in all phanerogams and in some cryptogams.

FIBRO-VASCULAR SYSTEM.—A mixture of woody and vascular tissue.

BAST TISSUE. — The tough, woody tissue of the *liber* or inner bark.

INTERCELLULAR SPACES. — Cavities between the cells of a tissue, formed either by the splitting of the common wall of adjacent cells, or by the destruction of certain cells (Fig. 192 a). These spaces contain air or certain resinous or oleaginous substances.

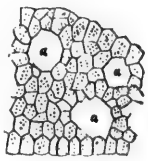


FIG. 192

CELLULAR STRUCTURE OF ORGANS.

EPIDERMIS.—The epidermis, or outer skin of plants, is formed of one or more layers of flattened, usually empty, thick walled cells, in close contact, except where there are stomata. It covers all parts of the plant directly exposed to the air, except the stigma (Fig. 198).

Stomata, small, mouth-shaped orifices in the epidermis, communicating with intercellular spaces, and having the power of opening or closing according to the conditions of light, moisture, and temperature. They are found chiefly in the epidermis of the leaf. They regulate the evaporation and respiration in the plant (Fig. 193 a).

FIG. 193.

Hairs, hair-like elongations of particular epidermal cells. They may consist of a single cell or of several cells placed end to end, and may be simple or branched.

Bristles, rigid hairs, consisting usually of a single, thick-walled cell.

Prickles, indurated and sharp pointed processes of the epidermis, consisting of a great number of thick-walled woody cells. Ex., Rose.

Stinging Hairs, those which consist of a rigid pointed cell, borne on an expanded, cushion-like base, which secretes an acrid, irritating fluid. Ex., Nettle.

Fig. 194.

Glands, appendages of the epidermis, consisting of a number of cells in which various liquids are secreted.

STEM.

1. Of Exogens.—In the young plant the stem consists of a central pith of cellular tissue surrounded by wedge-shaped fibro-vascular bundles, separated from one another by cellular tissue. On the outside of this zone is the bark, consisting at first of cellular tissue. (Fig. 194). As the plant becomes older the fibro-vascular bundles become larger, and the tissue of the inner bark becomes tougher After the first year of its growth the exogenous stem consists of:

(a) *Pith*, a cylinder of cellular tissue at the centre of the stem (Fig. 195, A a).

(b) *The Wood*, a zone of woody and vascular tissue surrounding the pith (Fig. 195, A c).

Medullary Sheath, a term sometimes applied to the earliest formed vascular tissue, immediately surrounding the pith (Fig. 195, A b).

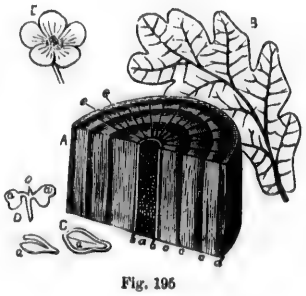


Fig. 196

(c) *Medullary Rays*, radiating lines of cellular tissue extending from the pith to the bark, and serving to keep up the communication between them (Fig. 195, A e).

(d) *Bark*, a circle surrounding the wood, consisting of the *inner* bark of bast tissue, and *outer* bark of cellular tissue (Fig. 195, A d).

(e) *Epidermis*, the skin surrounding the whole.

Cambium Layer, a layer of soft, newly formed cells, between the wood and the bark. The growth of the stem takes place in this layer.

2. Of Endogens.—The endogenous stem consists of bundles of woody and vascular tissue in the form of fibers (Fig. 196, A c and f), embedded in cellular tissue. The whole is surrounded by an integument which differs from a true bark in that it does not increase in layers and is not separate from the wood. The growth consists in the increase in the number of woody bundles, which spring from the base of new leaves and descend obliquely to the centre of the stem, then, curving outward, usually terminate in the circumference.

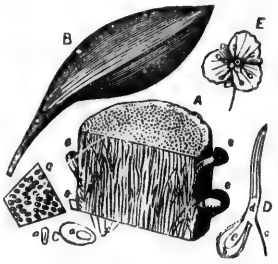


Fig. 196.

ROOT.—The root is constructed on the same general plan as the stem. The distinction between exogens and endogens is not so marked. The fibro-vascular tissue of exogens is seldom arranged in distinct concentric rings. There is no distinct pith, and there are no stomata in the epidermis. It develops no buds or leaves. The extremities of the roots and rootlets are tipped with a *root-cap* of dead cells (Fig. 197, a), which serves to protect the growing part of the root as it pushes its way through the earth. The growth of the root takes place just behind this root-cap (Fig. 197, b).

Fig. 197.

LEAF.—The tissue of the framework belongs to the fibro-vascular system, while that of the remainder of the leaf consists of thin-walled cells of parenchyma, containing grains of chlorophyll. The stratum forming the upper surface of horizontal leaves, consists of one or more layers of oblong cells, placed vertically, with their smaller ends next the surface, and with few or no stomata in the epidermis. The cells of the stratum forming the lower surface are more loosely placed, and when oblong, are arranged horizontally (Fig. 198). Numerous stomata in the epidermis communicate with the intercellular spaces. The two surfaces of vertical leaves are nearly alike in structure. The floral envelopes and essential organs of the flower, since they are really modifications of the leaf, resemble it in anatomical structure.

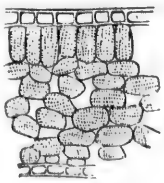


Fig. 198.

LIFE.

GROWTH.

The growth of the plant consists in the formation of new cells, and in the increase of these in size.

CELL MULTIPLICATION—The increase in the number of cells is principally due to the division of those already formed. The nucleus of an active cell divides into two parts, and a partition, formed from the lining of the cell, grows across it between these parts, thus forming two cells. These again divide into two others and so on.

CELL GROWTH—After the formation of a new cell, its walls usually increase in both surface and thickness by the building in of new particles of cellulose, secreted by the protoplasm, among those already formed. As this growth is not uniform throughout the whole cell-wall, the shape of the cell is likely to change. When the cell-walls cease to grow by the incorporation of new particles among the old, they may still continue to increase in thickness by the deposition of cellulose on their inner surfaces, the cavities of the cells becoming in some cases almost completely filled up. The hard wood, and the stony parts of the fruit are formed in this way. The various markings found on the cell-walls result from irregularity in the thickening.

POINTS OF GROWTH.—Cell multiplication takes place only in the active cells of certain parts of the plant.

(1) At the apices of buds.

(2) At the tips of roots, just behind the root caps.

(3) In the cambium layer of exogenous trees.

Tissue in which the cells are capable of division is called *formative* or *generating*, while that in which they are not, is called *permanent*.

CONDITIONS OF GROWTH.—The growth of the plant is conditioned on :

(1) The consumption of food,

(2) The inhalation and exhalation of oxygen.

(3) Warmth and light.

FOOD.

The nature of the food of plants can be determined by ascertaining the substances which they contain. The principal of these are carbon, oxygen, nitrogen, hydrogen and certain earthy or mineral substances The carbon is derived from carbon dioxide, the oxygen and hydrodrogen from water and the nitrogen chiefly from ammonia. The way in which the elements in these compounds become constituents of the plant will be best understood by a consideration of the functions of certain organs of the plant.

FUNCTIONS OF ROOT.

The following are the principal functions of the root :

(1) To fix the plant in position.

(2) To imbibe, principally through the rootlets, liquid nourishment (the *crude sap*). This consists of water in which is dissolved nitrogen, carbon dioxide, ammonia and various earthy substances.

(3) To transmit the crude sap to the stem.

(4) The tap roots of biennial plants act as storehouses of food for use during the second year of their growth.

(5) The roots of Epiphytes or Air-plants draw nourishment from the air, while those of Parasites strike into the new wood of other plants and take nourishment from their sap.

FUNCTIONS OF STEM.

The following are the principal functions of the stem:

(1) To support the leaves, flowers and fruit.

(2) To transmit the crude sap to the leaves.

(3) To transmit the assimilated matter to the growing parts of the plant. (See METASTASIS, below).

(4) The underground forms of the stem, *tubers*, *bulbs*, *corms*, contain prepared nourishment for their buds.

TRANSMISSION OF THE SAP.—The transmission of the crude sap through the root and the stem takes place in accordance with the law Endosmose.

Law of Endosmose.—This law is that when two fluids of different densities are separated by a membrane or porous partition, an interchange takes place, a larger quantity of the lighter flowing into the denser, but a smaller quantity of the denser flowing into the lighter. As the cell-sap is much denser than the moisture of the ground, a large quantity of the moisture finds its way through the permeable walls of the cells in contact with the ground, while but a small quantity of the cell-sap passes into the ground. Thus an upward current is produced in the crude sap, which is attracted to the leaves by the evaporation going on there.

FUNCTIONS OF LEAVES.

(1) Through the stomata of the leaves the plant inhales carbon dioxide from the air.

(2) Through the stomata also the superfluous water in the crude sap is evaporated.

(3) In the leaves the process of *assimilation* mostly takes place.

ASSIMILATION. — The process by which the inorganic materials taken from the earth and air are formed into organic food for the plant. The carbon dioxide is decomposed under the influence of sunlight in the cells containing chlorophyll. The oxygen is exhaled and carbon unites with the hydrogen and the oxygen of the water of the sap to form a carbohydrate, usually starch.

METASTASIS.—The starch when formed becomes soluble, diffuses to other parts of the plant, and undergoes certain chemical changes, to which the term *metastasis* has been applied. Oxygen is taken up, carbon dioxide liberated, and certain substances chemically similar to

starch formed. The most common of these are glucose ($C_{12}H_{24}O_{12}$), inuline ($C_{12}H_{20}O_{10}$), and cane-sugar ($C_{12}H_{22}O_{11}$). These compounds either find their way to the growing parts of the plant and are used up in connection with imbibed nitrates and sulphates in the formation of the protoplasm of new cells, or they are converted into starch or oily matter and stored up in certain parts of the plants as "reserve material" for future use.

REPRODUCTION.

There are two principal methods by which flowering plants are propagated:

(1) FROM SEEDS.—When the seed is placed in the soil it will, under favorable conditions of moisture and warmth, germinate, and from it will be produced a new plant. The young plantlet is nourished while its organs are undeveloped, either by the albumen of the seed (Wheat, Oats, Indian Corn), or by prepared food laid up in the cotyledons (Pea, Bean, Acorn, Horse-chestnut, Maple-Seed).

(2) FROM BUDS.—Propagation by buds may take place.

(i) Naturally by:

(a) *Stolons*, *Offsets*, *Runners* and *Suckers*, the nourishment being derived at first from the parent plant.

(b) *Tubers*, *Bulbs*, and *Corms*, the nourishment being derived from the prepared food laid up in them.

(ii) Artificially by:—

(a) *Layering*, that is, by bending a shoot of a stem into the ground, the shoot striking root while being fed by the parent plant.

(b) *Slips*, that is, by cutting off shoots containing buds from a stem, and placing the cut ends in the ground.

(c) *Grafting*, that is, by inserting shoots from the stem of one plant into the stem of a plant of the same or of a kindred species.

(d) *Budding*, that is, by inserting a bud from one plant under the bark of another.

Flowerless plants are propagated by means of spores. The spore, under favorable conditions, develops, and gives rise to a small, green, leaf-like film (the *prothallus*), on the under side of which are produced minute cellular structures (*antheridia* and *archegonia*), which answer to the stamens and the carpels of flowering plants. From the union of the contents of these, are produced buds, from which new plants grow.

LABORATORY WORK.

I.—Make the following observations and experiments, describe clearly and concisely the results, and illustrate your descriptions with appropriate drawings:—

1. Plant wheat, oats, beans, peas, Indian corn, pumpkin seeds, etc., and observe the different stages in their development. Endeavor to determine how the young plantlets are nourished before their organs are developed.
2. Go to the woods in the proper seasons, dig up germinating acorns, maple seeds, etc., observe the different stages in their development. Endeavor to determine how the young plantlets are nourished before their organs are developed.
3. Plant several potatoes and onions, and observe the changes which take place in them and the progress of the development of the young plants.
4. Obtain a number of buds from different plants, pick them to pieces, and observe their structure.
5. Observe the way in which the following climb: (1) the Hop, (2) the Morning Glory, (3) the Grape, (4) the Bean, (5) the Poison Ivy, (6) Virginia Creeper.
6. Examine (1) prickles, (2) spines in several plants.
7. Make a series of observations to determine the different ways in which pollen grains reach the stigmas of plants.
8. Observe the changes which take place in the development from the flower of (1) a strawberry, (2) a raspberry, (3) an apple.
9. Examine adventitious buds in several plants. Determine the cause of their formation.
10. Make a series of observations to determine the different ways in which seeds are scattered.
11. Place the same plants in different conditions of light and temperature and observe the effects.
12. Plant several seeds of the same kind in the same kind of soil, and observe their development under different conditions of temperature and light.
13. Make a series of experiments to show the effects of fertilizers on plants.
14. Make a series of experiments to show the effects of cultivation on plants.
15. Make a series of experiments in cross fertilization.
16. Make a series of experiments to show:
    (1) That plants in sunlight inhale carbon dioxide and exhale oxygen.
    (2) That plants in the dark inhale oxygen and exhale carbon dioxide.
    (3 That plants absorb moisture by their roots and transpire it by their leaves.
17. Observe the changes that take place in autumn in the leaves of several common trees. Discover the cause of the fall of the leaf.
18. Examine the construction of several common seeds.
19. Observe the arrangement of leaves on the stem. Determine the relation of whorls to spirals.
20. Examine diseased plants: (1) Wounds caused by mechanical influences; (2) Disease due to improper amounts of heat, moisture, etc.; (3) Diseases that come from the action of parasitic plants.
21. Examine several parasites.

*II.—Make experiments and observations to determine answers to the following questions:

1. Is there any definite proportion of active to dormant buds in any year?
2. Can the smallest, old, or dormant buds be made to grow?
3. Is there any order as to what buds grow and what remain dormant?
4. Is there any agreement in growth as to the length of branch and size of the annular ring
5. Does the amount of growth in any year correspond to the number of leaves on the twigs and main axis?
6. Does the ring of wood depend on the growth of the main axis?
7. Is there any certain number of leaves on a year's growth, or any definite proportion between the length of the internodes?
8. Is there any similarity of rapid or slow growth of all the limbs on a branch in each year?
9. How many leaves each year are required to build up a branch?
10. How great is the extent of leaf surface exposed for each branch?
11. Is there any order in the arrangement of the specks on a branch?
12. For what do ants visit plants?

* From Prof. Beal's paper on "The New Botany."

INDEX.

INDEX.

INDEX.

No.	NAME.	No.	NAME.

INDEX.

DESCRIPTION OF PLANT.

ROOT.

Kind	Primary
Shape	Fibrous
Duration	Perennial

STEM.

Class	
Kind	
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	Radical
Phyllotaxis	
Parts	Petiolate Estipulate
Kind	simple
Veration	Palmately veined
Outline	
Margin	lobed
Apex	
Base	
Lobes	
Surface	
Duration	
Color	

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx				
Sepals		5–12 Polysepalous	Inferior	Rosaceous oval
Corolla				
Petals				
Stamens		∞ Polyandrous Hypogynous		
Filaments				Filiform.
Anthers				oval innate.
Pistil				
Carpels		∞ Syncarpous		
Ovary Cells				
Styles				Short.
Stigmas				nearly round.

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	
Class	solitary
Symmetry	symmetrical
Regularity	irregular
Perfectness	perfect
Completeness	apetalous
Bracts	

FRUIT.

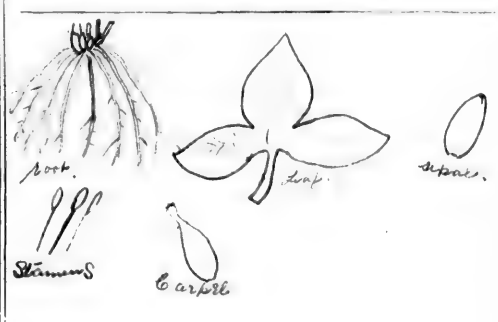
Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.



CLASSIFICATION.

Order	
Genus	
Species	
Name — Common	
Name — Scientific	

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

DESCRIPTION OF PLANT.

ROOT.

Kind	Secondary
Shape	Fibrous
Duration	Perennial

STEM.

Class	Exogenous
Kind	Caulis
Consistence	Herbaceous.
Shape	
Height	4 - 18 inches
Surface	Glabrous
Direction	Diffuse
Juice	Watery acrid
Branches	Branched.

LEAF.

Situation	Cauline Radical
Phyllotaxis	Opposite
Parts	Petiolate
Kind	Simple.
Veration	Palm ately net veined
Outline	Orbicular
Margin	Dentate
Apex	Obtuse
Base	Reniform
Lobes	
Surface	Glabrous
Duration	Deciduous
Color	Green.

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx				Braceous
Sepals	5	Polysepalous	Inferior	Ovate
Corolla				
Petals				
Stamens	∞	Polyandrous	Hypogenous	Included
Filaments				Filiform
Anthers				Adnate Introrse
Pistil				
Carpels	∞	Apocarpous	superior	
Ovarian Cells				
Styles		very short		
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Indeterminate
Class	Solitary
Symmetry	Irregular
Regularity	Regular
Perfectness	Perfect.
Completeness	Incomplete.
Bracts	none

FRUIT.

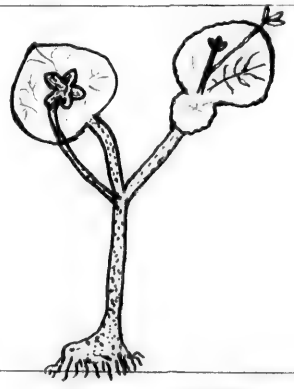
Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.



CLASSIFICATION.

Order	Ranunculaceae
Genus	Caltha
Species	Palustris
Name — Common	Marsh Marigold
Name — Scientific	Caltha Palustris

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Circles of flower leaves i.e. Sepals petals stamens & carpels unconnected with each other
2. Several members each circle entirely unconnected
3. Stamens almost invariably numerous
4. Plants are acrid in taste.

DESCRIPTION OF PLANT.

ROOT.

Kind	Primary
Shape	Taper
Duration	Biennial

STEM.

Class	Exogenous
Kind	Acaulescent.
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	Radical
Phyllotaxis	Whorled
Parts	Petiolate Estipulate
Kind	Simple
Veration	Net veined
Outline	
Margin	Lobed
Apex	Acute
Base	Tapering
Lobes	Runcinate
Surface	Short hairs
Duration	Deciduous
Color	Green

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx	5	Gamocefalous	Superior	
Sepals				
Corolla			Epigynous	Ligulate
Petals	5	Gamopetalous		
Stamens		Epipetalous		
Filaments				
Anthers		Syngenesious		
Pistil				
Carpels		syncarpous		
Ovary Cells			Inferior	
Styles				
Stigmas				Bifid

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Indeterminate
Class	Head
Symmetry	unsymmetrical
Regularity	Regular
Perfectness	Perfect
Completeness	Complete.
Bracts	Involucre surrounding flower cluster

FRUIT.

Kind	
Dehiscence	
When Ripe	

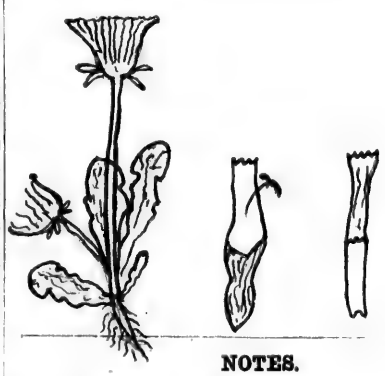
SEEDS.

Number	
Kind	
Embryo	

REMARKS.

No of sepals inferred from no of petals

DRAWINGS.



CLASSIFICATION.

Order	Compositae-Liguliflorae	Habitat
Genus	Taraxacum	Locality
Species	Dens leonis	Date
Name: Common	Dandelion	Number
Name: Scientific	Taraxacum Dens leonis	

NOTES.

CHARACTERS OF THE ORDER.

1. Flowers in heads packed on common receptacle and surrounded by involucre
2. Stamens are epipetalous.
3. Stamens are syngenesious.
4. Style is two lobed at apex.

DESCRIPTION OF PLANT.

ROOT.

Kind	
Shape	
Duration	

STEM.

Class	
Kind	
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	Cauline
Phyllotaxis	Whorled
Parts	Petiolate
Kind	Simple
Veration	Pinnately net veined
Outline	Ovate
Margin	serrate
Apex	Acute
Base	Tapering
Lobes	
Surface	Hairy
Duration	Deciduous
Color	Green

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx				
Sepals	5	Gamosepalous	Inferior	Rotate
Corolla	5	Polypetalous		Rosaceous
Petals				
Stamens	∞	Polyandrous.	Perigynous	
Filaments				filiform
Anthers				
Pistil				
Carpels	∞	apocarpous		
Ovary Cells				flattened at top
Styles				filiform.
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Determinate
Class	Clustered
Symmetry	Unsymmetrical
Regularity	Regular
Perfectness	Perfect
Completeness	Complete
Bracts	

FRUIT.

Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.

CLASSIFICATION.

Order		Rosaceae
Genus		Prunus
Species		Americana
Name	Common	Wild plum
	Scientific	Prunus Americana

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Petals inserted on corolla is Perigynous
2. Stamens numerous and perigynous
3. Pistil except in apple is apocarpous & superior
4. Leaves are stipulate

DESCRIPTION OF PLANT.

ROOT.

Kind	Secondary
Shape	Fibrous
Duration	Biennial

STEM.

Class	Endogenous
Kind	caulis and bulb
Consistence	Herbaceous
Shape	Rounds
Height	4-6 inches
Surface	Glabrous
Direction	Erect.
Juice	Watery
Branches	0

LEAF.

Situation	Cauline
Phyllotaxis	Opposite
Parts	Sheathed Estipulate
Kind	Simple
Veration	Straight veined
Outline	Linear-Lanceolate
Margin	entire.
Apex	Acute
Base	tapering
Lobes	
Surface	Glabrous
Duration	Deciduous
Color	Green with dark spots.

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				Liliaceous
Leaves	6.	Polyphyllous	Inferior	Lanceolate
Calyx				
Sepals				
Corolla				
Petals				
Stamens	6	Hexandrous	Hypogynous	
Filaments				Subulate Included
Anthers	6			Oblong innate Rounded
Pistil	1.			
Carpels	3.	Syncarpous		
Ovary Cells	3		superior	Triangular
Styles	3.			[redacted]
Stigmas	3.			Trifid

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Determinate
Class	solitary
Symmetry	Symmetrical
Regularity	regular
Perfectness	Perfect
Completeness	Complete
Bracts	

FRUIT.

Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

Stamens opposite each leaf of Perianth

DRAWINGS.

CLASSIFICATION.

Order	Liliaceae	
Genus	Erythronium	
Species	Americanum	
Name — Common	Dogtooth-violet	
Name — Scientific	Erythronium - Americanum	

NOTES.

Habitat	
Locality	moist Ground.
Date	May.
Number	

CHARACTERS OF THE ORDER.

DESCRIPTION OF PLANT.

ROOT.

Kind	Secondary
Shape	Fibrous
Duration	Biennial

STEM.

Class	Endogenous
Kind	Rhizoma - Caulis
Consistence	Herbaceous
Shape	Rounded
Height	5-8 inches
Surface	Glabrous
Direction	Erect
Juice	Watery
Branches	none.

LEAF.

Situation	Cauline
Phyllotaxis	Whorled
Parts	sessile
Kind	simple
Veration	net-veined
Outline	Deltoid
Margin	Entire
Apex	Tapering
Base	
Lobes	
Surface	Glabrous.
Duration	Deciduous.
Color	Dark Green.

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx				Liliaceous
Sepals	3.	Polysepalous	Inferior	Lanceolate
Corolla				Rosaceous
Petals	3	Polypetalous	Hypogynous.	
Stamens	6	Hexandrous		
Filaments				Filiform
Anthers				Oblong-adnate-introrse
Pistil				
Carpels	3	syncarpous	Superior	
Ovary Cells				Hexagonal
Styles				
Stigmas				Trifid

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Determinate
Class	solitary
Symmetry	symmetrical
Regularity	Regular
Perfectness	Perfect
Completeness	Complete
Bracts	none

FRUIT.

Kind	
Dehiscence	
When Ripe	

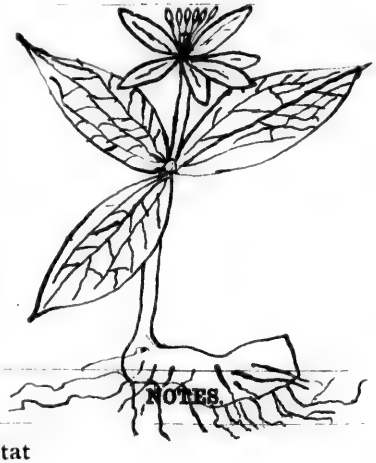
SEEDS.

Number	
Kind	
Embryo	

REMARKS.

six stamens are opposite each flower

DRAWINGS.



CLASSIFICATION.

Order	Liliaceae
Genus	Trillium
Species	Grandiflorum
Name — Common	White Trillium
Name — Scientific	Trillium Grandiflorum

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Parts of flowers almost invariably in sets of threes the perianth and stamens consisting each of two such sets
2. Flowers are symmetrical and regular
3. Stamens opposite the division of Perianth
4. The ovary is nearly always 3-celled and is superior

Phaenogamous or Phanogams are flowering { Gymnospermous / Endospermous
Cryptogams or Flowerless plants.

DESCRIPTION OF PLANT.

ROOT.

Kind	Secondary
Shape	Fibrous
Duration	Perennial

STEM.

Class	Endogenous
Kind	Corm & Caulis
Consistence	
Shape	Round
Height	1–2 feet
Surface	Glabrous
Direction	Erect
Juice	Acrid
Branches	

LEAF.

Situation	Cauline
Phyllotaxis	Alternate.
Parts	Sheathed & Estipulate
Kind	Compound Trifoliate Radical
Veration	Pinnately net-veined
Outline	Obovate.
Margin	Entire
Apex	Acute
Base	Tapering
Lobes	
Surface	Glabrous
Duration	Deciduous
Color	Green

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx				
Sepals				
Corolla				
Petals				
Stamens	∞			
Filaments		Monandrous		very short
Anthers				2 or 4 lobed.
Pistil				
Carpels	∞	Apocarpous		Round
Ovary Cells				Round
Styles				sessile.
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Indeterminate
Class	Spadix
Symmetry	
Regularity	
Perfectness	Dioecious
Completeness	Achlamydeous
Bracts	Spadix surrounded by spathe.

FRUIT.

Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.

CLASSIFICATION.

Order	Araceae
Genus	Arisaema
Species	Triphyllum
Name — Common	Indian Turnip
Name — Scientific	

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Flowers arranged in a spadix generally surrounded by a spathe.
2. Flowers either without a perianth or with 4–6 sepals.
3. Fruit generally a berry.

DESCRIPTION OF PLANT.

ROOT.

Kind

Shape

Duration

STEM.

Class

Kind

Consistence

Shape

Height

Surface

Direction

Juice

Branches

LEAF.

Situation

Phyllotaxis

Parts

Kind

Veration

Outline

Margin

Apex

Base

Lobes

Surface

Duration

Color

FLOWER.

ORGAN.	NO.	COHESION.	ADHESION.	FORM, &C.
Perianth				
Leaves				
Calyx			Inferior	Campanulate
Sepals	5	Gamosepalous	~~Inferior~~	
Corolla				
Petals				
♂ Stamens	variable	Polyandrous	Perigynous	Included
Filaments				Filiform
Anthers				Innate-Oblong
♀ Pistil				
Carpels	2	Syncarpous		
Ovary Cells			superior	
Styles				Bifid
Stigmas				Bifid

♂ Denotes Stamens in Staminate flowers

♀ Denotes Pistil in Pistillate flowers

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Raceme
Class	Indeterminate
Symmetry	
Regularity	
Perfectness	Dioecious & Polygamous
Completeness	
Bracts	

FRUIT.

Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

On some trees perfect and staminate flowers will be found on others perfect and pistillate flowers

DRAWINGS.

CLASSIFICATION.

Order		Sapindaceae
Genus		Acer
Species		Saccharinum
Name	Common	Sugar maple
	Scientific	Acer Saccharinum

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Flowers dioecious and Polygamous & unsymmetrical
2. Ovary is two lobed and two celled with two ovules in each cell only one of which however is ripened
3. Fruit is a double Samara
4. Leaves are opposite

DESCRIPTION OF PLANT.

ROOT.

Kind	Primary
Shape	Tap
Duration	Biennial

STEM.

Class	Dicotyledons
Kind	Culms
Consistence	Fruticose
Shape	compressed
Height	6-12 inches
Surface	Hairy Glabrous
Direction	Erect
Juice	Acrid
Branches	Branched

LEAF.

Situation	Radical & Cauline
Phyllotaxis	Alternate
Parts	Sessile Petiolate
Kind	
Veration	Net-veined
Outline	
Margin	Entire
Apex	Acute
Base	
Lobes	Entire
Surface	Glabrous
Duration	Deciduous
Color	

FLOWER.

ORGAN.	NO.	COHESION.	ADHESION.	FORM, &C.
Perianth				
Leaves				
Calyx				
Sepals	4	Polysepalous	Inferior	Cruciform
Corolla				
Petals	4	Polypetalous	Hypogynous	Cruciform
Stamens	6	Hexandrous		Tetradynamous
Filaments	4 long 2 short		Hypogynous	Filiform
Anthers	6			
Pistil				
Carpels	2	Syncarpous	Superior	
Ovary Cells				
Styles				
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	
Class	Definite
Symmetry	Monosymmetrical
Regularity	Irregular
Perfectness	Perfect
Completeness	
Bracts	

FRUIT.

Kind	Silique
Dehiscence	
When Ripe	

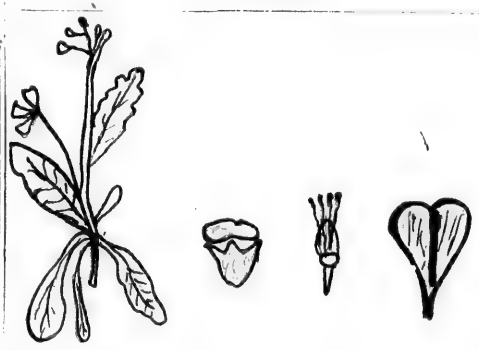
SEEDS.

Number	
Kind	
Embryo	

REMARKS.

Rachis leaves tapering
at the ends [illegible]

DRAWINGS.



CLASSIFICATION.

Order	Cruciferae	
Genus	Brassica	
Species	[illegible] Pabularia	
Name — Common	[illegible]	
Name — Scientific	Capsella	

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Sepals & petals each four in number
2. Stamens 6 tetradynamous & hypogenous
3. Fruit a capsule & two celled by reason of a thin
partition between the valves
4. Seeds are usually [illegible]

DESCRIPTION OF PLANT.

ROOT.

Kind	Primary
Shape	Tap
Duration	Perennial

STEM.

Class	Exogenous
Kind	Caulis
Consistence	Herbaceous
Shape	Round
Height	8 - 10
Surface	Hairy
Direction	erreet
Juice	Watery
Branches	none

LEAF.

Situation	Cauline
Phyllotaxis	Alternate
Parts	Petiolate stipulate
Kind	simple
Veration	Palmately net-veined
Outline	Reniform
Margin	Crenate
Apex	
Base	Reniform
Lobes	
Surface	Hairy
Duration	Persistant
Color	Green

FLOWER.

ORGAN.	NO.	COHESION.	ADHESION.	FORM, &C.
Perianth				
Leaves				
Calyx				Campanulate
Sepals	5	Gamosepalous	Inferior	
Corolla				Lilaceous
Petals	5	Polypetalous	Hypogynous	Obovate
Stamens	∞			
Filaments		Monadelphous	Hypogynous	Included
Anthers				
Pistil				
Carpels	∞	Syncarpous	Superior	
Ovary Cells				
Styles				
Stigmas				Lengthened

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Indeterminate
Class	Solitary
Symmetry	Unsymmetrical
Regularity	Regular
Perfectness	Perfect
Completeness	Complete
Bracts	Involucre surrounding flower Cluster

Surrounds Calyx.

FRUIT.

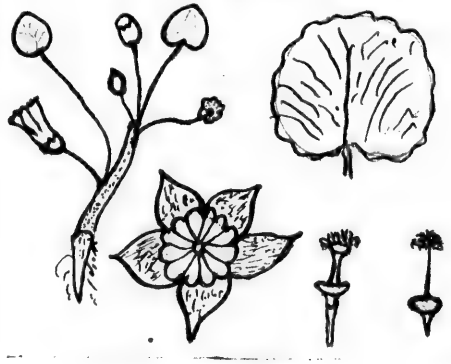
Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.



CLASSIFICATION.

Order	Malvaceae.
Genus	Malva.
Species	Rotundifolia
Name — Common	Mallow
Name — Scientific	Malva. Rotundifolia

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Sepals valvate in the bud and convolute
2. Stamens numerous and monadelphous.
3. Although united at the base with the claws of the petals they are never the less united with the receptacle
4. 5 carpels united in a ring (5) Leaves Stipulate
6. Juice of Plants Mucilaginous.

DESCRIPTION OF PLANT.

ROOT.

Kind	Primary
Shape	Fibrous
Duration	Perennial

STEM.

Class	Exogenous
Kind	Caulis
Consistence	Herbaceous
Shape	Triangular
Height	8–18 inches
Surface	Hairy
Direction	Diffuse
Juice	Watery
Branches	Branched.

LEAF.

Situation	Radical Cauline
Phyllotaxis	Alternate
Parts	Petiolate and Estipulate
Kind	Compound
Veration	net-veined
Outline	Decompound.
Margin	doubly serrate
Apex	Acute
Base	Tapering
Lobes	
Surface	smooth
Duration	Deciduous
Color	Green.

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx				
Sepals	5	Polysepalous	Inferior	
Corolla				
Petals	5	Polypetalous	Hypogynous	
Stamens	∞			
Filaments		Polyandrous	Hypogynous	
Anthers				
Pistil				
Carpels		Apocarpous	superior	
Ovary Cells				
Styles				
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	
Class	
Symmetry	
Regularity	
Perfectness	
Completeness	
Bracts	

FRUIT.

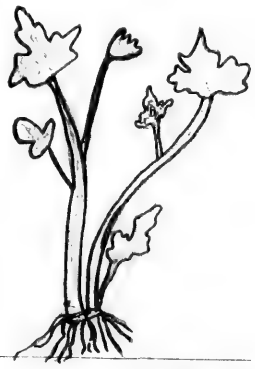
Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.



CLASSIFICATION.

Order		Ranunculaceae
Genus		Ranunculus
Species		Acris.
Name	Common	Buttercup
	Scientific	Ranunculus Acris

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Flowers dioecious and Irregular
2. Ovary is ~~two lobed and two celled with two ovules in each cell only one of which is ripened.~~
3. Fruit is a ~~double samara leaves opposite~~.

DESCRIPTION OF PLANT.

ROOT.

Kind	
Shape	
Duration	

STEM.

Class	
Kind	
Consistence	
Shape	
Height	12 · 15
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	
Phyllotaxis	
Parts	
Kind	
Veration	
Outline	
Margin	
Apex	
Base	
Lobes	
Surface	
Duration	
Color	

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx				
Sepals	5			
Corolla				
Petals				
Stamens	10			
Filaments				
Anthers				
Pistil	1			
Carpels	1			
Ovary Cells				
Styles				
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	
Class	
Symmetry	
Regularity	
Perfectness	
Completeness	
Bracts	

FRUIT.

Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.

CLASSIFICATION.

Order	
Genus	
Species	
Name — Common	
Name — Scientific	

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

DESCRIPTION OF PLANT.

ROOT.

Kind	Secondary
Shape	Tuberous or Fib.
Duration	Perennial

STEM.

Class	
Kind	
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	
Phyllotaxis	
Parts	
Kind	
Veration	
Outline	
Margin	
Apex	
Base	
Lobes	
Surface	
Duration	
Color	

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx Glumes	2.			
Sepals				
~~Corolla~~ Palets	2.			
Petals				
Stamens	3			Bifid
Filaments		Distinct	Perigynous	capillary
Anthers				Linear versatile
Pistil	1		Superior	
Carpels				
Ovary Cells				
Styles				
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind
Class
Symmetry
Regularity
Perfectness
Completeness
Bracts

FRUIT.

Kind
Dehiscence
When Ripe

SEEDS.

Number
Kind
Embryo

REMARKS.

DRAWINGS.

CLASSIFICATION.

Order
Genus
Species
Name { Common / Scientific }

NOTES.

Habitat
Locality
Date
Number

CHARACTERS OF THE ORDER.

Plants with culms hollow except at joints (2) leaves sheathed & ligulate (3) Flowers in spikes each flower in the axil of a glume like spike (4) Ovary one celled becoming an akene (5) Styles two cleft (6) Stamens mostly three

Corn-plants — Timothy, Red top, Meadow grass, Chess, Couch grass, Foxtail, &c.

DESCRIPTION OF PLANT.

ROOT.

Kind	Secondary Root-[illegible]
Shape	
Duration	

STEM.

Class	
Kind	Caulis
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	
Phyllotaxis	
Parts	
Kind	
Veration	
Outline	
Margin	
Apex	
Base	
Lobes	
Surface	
Duration	
Color	

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth	6.			Hypogynous
Leaves	6.	Gamophyllous	superior	Obl Lanceolate
Calyx				
Sepals				
Corolla				
Petals				
Stamens	3			
Filaments		Triandrous		Included
Anthers				linear obtuse Introrse
Pistil		Inferior		
Carpels	3.	Syncarpous		
Ovary Cells				Triangular
Styles				Petaloid
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	Solitary
Class	
Symmetry	
Regularity	
Perfectness	
Completeness	
Bracts	

FRUIT.

Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.

CLASSIFICATION.

Order		Iridaceae
Genus		Iris
Species		Versicolor
Name	Common	Blue flag
	Scientific	Iris Versicolor.

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

1. Herbs with equitant leaves (2) Flowers perfect perianth being divided into two sets of 3 each
(3) She adherent to a three celled ovary.
(4) Stamens three distinct or monadelphous opposite 3 stigmas
(5) Anthers extrorse (6) Flowers grow from leafy bracts

Crocus, Gladiolus.

DESCRIPTION OF PLANT.

ROOT.

Kind	Fibrous
Shape	secondary
Duration	

STEM.

Class	Exogenous
Kind	Caulis
Consistence	Herbaceous
Shape	grooved
Height	
Surface	Glabrous
Direction	Diffuse
Juice	watery
Branches	Creeping

LEAF.

Situation	Caulis
Phyllotaxis	alternate
Parts	petiolate - Stipulate
Kind	
Veration	feather veined
Outline	Palmately trifoliate ovate
Margin	entire
Apex	
Base	Retuse
Lobes	
Surface	smooth
Duration	
Color	Green with streak

FLOWER

Organ.	No.	Cohesion.	Adhesion	Form, &c.
Perianth				
Leaves				
Calyx				
Sepals	5	Gamosepalous	Inferior	Campanulate
Corolla				Papilionaceous
Petals	5	Gamopetalous	Perigynous	Piliform & Tubular
Stamens	10	Diadelphous		
Filaments			perigynous	piliform & Tubular
Anthers				
Pistil				
Carpels	1	Apocarpous	superior	
Ovary Cells				Legume Seeds 1-4
Styles		simple		
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	
Class	
Symmetry	
Regularity	
Perfectness	
Completeness	
Bracts	

FRUIT.

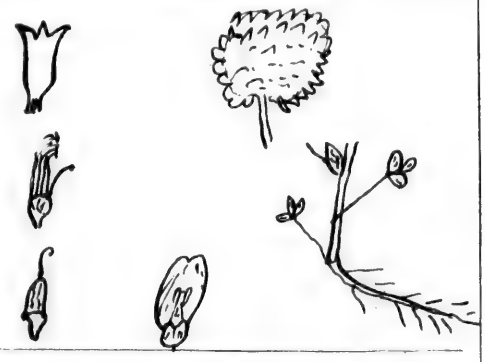
Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.



CLASSIFICATION.

Order	Leguminosae
Genus	Trifolium
Species	Repens
Name — Common	White clover
Name — Scientific	

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

DESCRIPTION OF PLANT.

ROOT.

Kind	Tap
Shape	conical
Duration	Primary

STEM.

Class	Exogenous
Kind	Caulis
Consistence	Herbaceous
Shape	Erect
Height	Rounded 2-3'
Surface	
Direction	
Juice	Watery
Branches	Branches at every leaf

LEAF.

Situation	Cauline
Phyllotaxis	Alternate
Parts	Estipulate
Kind	Herbaceous simple
Veration	net veined
Outline	oval-ovate
Margin	serrate
Apex	obtuse
Base	tapering
Lobes	pinnately lobed.
Surface	hairy.
Duration	
Color	

FLOWER.

Organ.	No.	Cohesion.	Adhesion.	Form, &c.
Perianth				
Leaves				
Calyx		Polysepalous.	Inferior	
Sepals	4.			
Corolla		Polypetalous	Hypogenous	cruciferous
Petals	4.			clawed valv
Stamens	6.	Hexandrous	Hypogenous	Tetradynamous
Filaments				filiform
Anthers				Oblong
Pistil			superior	
Carpels	2.	syncarpous		silique 4 sided beak
Ovary Cells				pod much knotted
Styles				filiform
Stigmas				rounded.

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	
Class	
Symmetry	
Regularity	
Perfectness	
Completeness	
Bracts	

FRUIT.

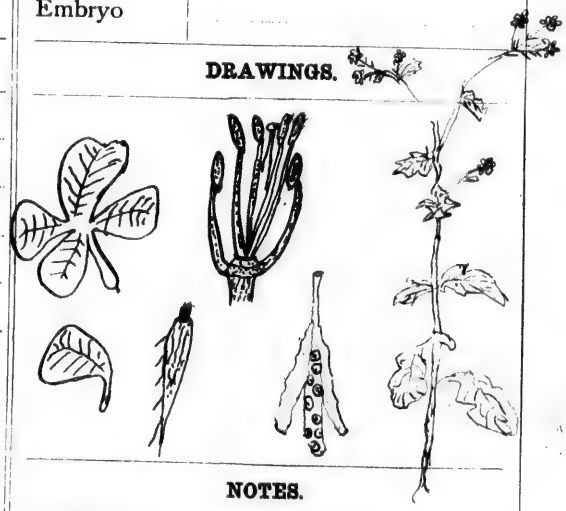
Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.



CLASSIFICATION.

Order	
Genus	
Species	
Name — Common	
Name — Scientific	

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

DESCRIPTION OF PLANT.

ROOT.

Kind	
Shape	
Duration	

STEM.

Class	
Kind	
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	
Phyllotaxis	
Parts	
Kind	
Veration	
Outline	
Margin	
Apex	
Base	
Lobes	
Surface	
Duration	
Color	

FLOWER.

ORGAN.	NO.	COHESION.	ADHESION.	FORM, &C.
Perianth				
Leaves				
Calyx				
Sepals				
Corolla				
Petals				
Stamens				
Filaments				
Anthers				
Pistil				
Carpels				
Ovary Cells				
Styles				
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	
Class	
Symmetry	
Regularity	
Perfectness	
Completeness	
Bracts	

FRUIT.

Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.

CLASSIFICATION.

Order	
Genus	
Species	
Name — Common	
Name — Scientific	

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

DESCRIPTION OF PLANT.

ROOT.

Kind	
Shape	
Duration	

STEM.

Class	
Kind	
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	
Phyllotaxis	
Parts	
Kind	
Veration	
Outline	
Margin	
Apex	
Base	
Lobes	
Surface	
Duration	
Color	

FLOWER.

ORGAN.	NO.	COHESION.	ADHESION.	FORM, &C.
Perianth				
Leaves				
Calyx				
Sepals				
Corolla				
Petals				
Stamens				
Filaments				
Anthers				
Pistil				
Carpels				
Ovary Cells				
Styles				
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind	
Class	
Symmetry	
Regularity	
Perfectness	
Completeness	
Bracts	

FRUIT.

Kind	
Dehiscence	
When Ripe	

SEEDS.

Number	
Kind	
Embryo	

REMARKS.

DRAWINGS.

CLASSIFICATION.

Order	
Genus	
Species	
Name — Common	
Name — Scientific	

NOTES.

Habitat	
Locality	
Date	
Number	

CHARACTERS OF THE ORDER.

DESCRIPTION OF PLANT.

ROOT.

Kind	
Shape	
Duration	

STEM.

Class	
Kind	
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	
Phyllotaxis	
Parts	
Kind	
Veration	
Outline	
Margin	
Apex	
Base	
Lobes	
Surface	
Duration	
Color	

FLOWER.

ORGAN.	NO.	COHESION.	ADHESION.	FORM, &C.
Perianth				
Leaves				
Calyx				
Sepals				
Corolla				
Petals				
Stamens				
Filaments				
Anthers				
Pistil				
Carpels				
Ovary Cells				
Styles				
Stigmas				

DESCRIPTION OF PLANT—Continued.

INFLORESCENCE.

Kind

Class

Symmetry

Regularity

Perfectness

Completeness

Bracts

FRUIT.

Kind

Dehiscence

When Ripe

SEEDS.

Number

Kind

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Consistence	
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Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	
Phyllotaxis	
Parts	
Kind	
Veration	
Outline	
Margin	
Apex	
Base	
Lobes	
Surface	
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DESCRIPTION OF PLANT—Continued.

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Perfectness	
Completeness	
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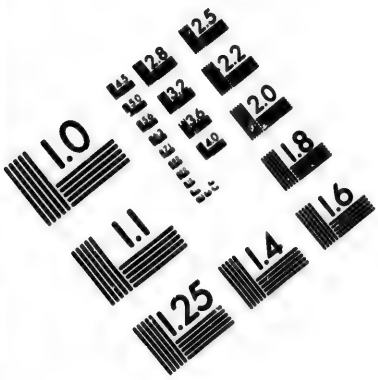

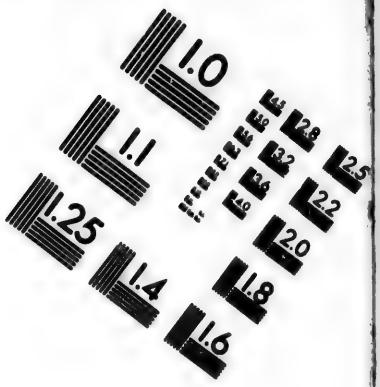

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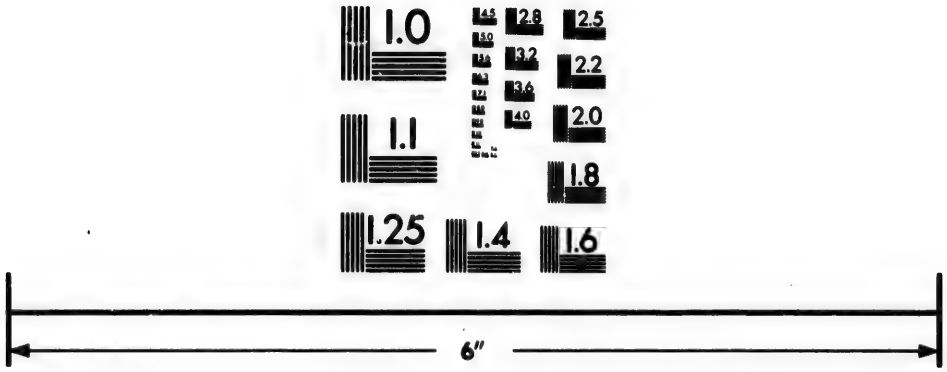

Photographic Sciences Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

DESCRIPTION OF PLANT.

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Kind	
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STEM.

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Kind	
Consistence	
Shape	
Height	
Surface	
Direction	
Juice	
Branches	

LEAF.

Situation	
Phyllotaxis	
Parts	
Kind	
Veration	
Outline	
Margin	
Apex	
Base	
Lobes	
Surface	
Duration	
Color	

FLOWER.

ORGAN.	NO.	COHESION.	ADHESION.	FORM, &C.
Perianth				
Leaves				
Calyx				
Sepals				
Corolla				
Petals				
Stamens				
Filaments				
Anthers				
Pistil				
Carpels				
Ovary Cells				
Styles				
Stigmas				

DESCRIPTION OF PLANT—Continued.

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Perfectness	
Completeness	
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DESCRIPTION OF PLANT—Continued.

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DESCRIPTION OF PLANT—Continued.

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